

NaCl Ord. test Sta

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THIRD QUARTERLY STATUS REPORT
Request No. R-05-030-001
for the period 1 August-31 October 1965

During the third quarter of the contract period, efforts were concentrated mostly on problems III 3 and III 6. Work on the other problems is going on, but no results have been obtained up to this time. The state of progress in the solution of problems III 3 and III 6 is as follows.

III 3. Comparison of theory and experiment.

The epitaxy experiments of Au on NaCl mentioned in the previous quarterly reports were continued and extended to include other alkali halide surfaces such as KCl and KBr. Many of the results obtained are included in Encl. 1, which is an invited review paper presented at the International Symposium on Basic Problems in Thin Film Physics, Clausthal-Göttingen, September 6-11, 1965. One of the more significant results not reported in Encl. 1 is the observation that Au does not develop a {111} orientation in thick films on KCl and KBr cleaved in ultrahigh vacuum, although {111} oriented crystals are observed before the coalescence of the individual crystals. Instead of the {111} orientation as observed in thick Au films on NaCl, a perfect epitaxial orientation is formed in thick Au films on KCl and KBr. This indicates that in the absence of residual gases the formation mechanisms of thin films becomes much more peculiar to the given film-substrate pair than previously assumed. Another important result obtained within this report period is that the bulk of the substrate itself can be a source of contamination in thin film growth. This can be concluded from line-of-sight mass spectrometer studies of the desorption products from NaCl surfaces when heated in ultrahigh vacuum. The rate at which impurities

N 66-80645

(ACCESSION NUMBER)	(THRU)
2	None
(PAGES)	(CODE)
CR-68727	
(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

FACILITY FORM 502

1965

(mainly H_2O) are released from the crystal depends in a complicated manner on temperature. This introduces additional complications in the temperature dependence of the film growth.

III 6. The monolayer growth of metals

Three new systems, Pb on the {110} plane of W, and Ag and Au on the {111} plane of Si were added to those reported in the last status report. The latter two systems were included as a check on the peculiarity of individual films deposited on Si surfaces. Ag and Au have about the same lattice constant and are both monovalent, so that geometric and electronic considerations would suggest very similar film structures for both materials. Experiment shows that this is not true. Pb on W is of interest because the binding forces between Pb atoms are much weaker than those between W atoms. This poses the question whether the Pb film will assume the structure of the substrate, or maintain the periodicity it has in the bulk, or assume an intermediate structure. Experiment shows that in one direction the Pb film has bulk atomic distances, but in the other direction it is strained to fit the substrate periodicity. The systems mentioned here and in the previous report are still being investigated.

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